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ON SUCCESSFUL BEEKEEPING.

NECTAR PRODUCING RESOURCES OF MICHIGAN

BY

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Director Apiary Inspection

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MICHIGAN DEPARTMENT OF AGRICULTURE

LANSING, MICHIGAN

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The State of Michigan has tremendous areas of untouched honey producing resources. The number of colonies of bees in the State is less than ten per cent of the number that would be required to conserve all the nectar that is being wasted annually. It is with the desire to bring to the attention of the beekeepers and others the opportunities presented here for profitable beekeeping that this circular is issued.

JOHN A. DOELLE,
Director Bureau of Agricultural Development.

OUTSTANDING FEATURES OF MICHIGAN BEEKEEPING

A soil where the clovers grow wild.

Millions of acres of red raspberry, fireweed, milkweed and goldenrod.

Comparative freedom from drought.

A cool, invigorating summer temperature.

Long days and short nights during the growing season.

Adequate rainfall.

Sunshine predominating.

White honeys of highest quality.

Long continued honey flows.

There are over 5,000 lakes and hundreds of trout streams.

Michigan is the summer playground of the Central States.

Thousands of high grade beekeeping locations unoccupied.

Winter temperatures tempered by the Great Lakes.

Abundant snowfall.

Markets unexcelled.

A constructive policy in disease control.

One of America's greatest deciduous fruit States.

Dandelion and other early wild flowers throughout the State.

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NECTAR PRODUCING RESOURCES OF MICHIGAN

Two natural factors which are of extreme importance in honey production and which cannot be modified by the beekeeper are climate and soil. Because of the unique situation of Michigan, being surrounded on all sides by water, excepting the western boundary of the Upper Peninsula and the southern boundary of the Lower Peninsula, this State is peculiarly favored in climatic conditions as compared with the other states in the same latitude. Inasmuch as Michigan was traversed by at least two of the great glaciers or ice sheets which came down from the north and northeast, much of the surface soil is extremely variable in character within relatively short distances.

SOILS OF THE LOWER PENINSULA

Lake Clay Areas. The best beekeeping soil, the lake clay, extends from the the Ohio line northward along the Detroit and St. Clair rivers and along the shores of Lake Huron to Mackinaw City. This area of soil marks the limits of the old lake bed. Between areas of lake clay there are found occasional tracts of water-washed sand. The best beekeeping territory in the State from the standpoint of the growth and abundance of clover and the natural resistance to drought is the lake clay area. The next best is that covered by the bowlder clay and the moraines. This type of soil is found immediately to the west and south of the lake clay soils and extends as far west as Lake Michigan. The clay soils are the best soils for beekeeping because of their natural resistance to drought and because they are the soils of best quality and therefore produce blossoms more abundantly and for a longer period of time. While the lake clay soils are distinctly clover soils, yet there are many other plants growing there which are of great value to the beekeeper. Golden rod, Canada thistle, basswood, sweet clover, raspberry, dandelion and many others grow on the clay soils or on their borders. There are few beekeepers in the heavy clay areas that do not secure surplus honey from one or more plants in addition to the clovers.

Sandy Areas. The sandy loam and the light sand drift are found in areas of greater or less extent throughout the State. The central part of the northern portion of the State, comprising the southeastern part of Antrim County, the southern part of Otsego County, the western part of Oscoda, and a large part of Crawford, Kalkaska, Roscommon, Ogemaw and Iosco Counties, comprise the great sand plain and only a limited part of these counties could be considered as of value in beekeeping. However, in travelling across the sand plains one is frequently surprised in coming upon very fertile tracts of heavy soil admirably adapted to beekeeping.

The Swamp Areas. The swamp lands become more and more valuable as sources of nectar as we approach the southern boundary of the State. The

yield from the swamp flowers during the months of August and September often constitutes as good a crop as may be secured from the clovers and other summer flowers. In the four southern tiers of counties, Spanish needle, goldenrod, boneset, verbena and asters are very valuable sources of fall honey.

It is interesting to note the changes that come in the swamp flowers as a result of the lowering of the water level through complete or partial drainage. In the southern part of the State, when a valueless swamp is partially drained, there soon springs up a heavy growth of Spanish needle which furnishes a valuable flow of nectar. If drainage is carried further, golden rod appears and Spanish needle may disappear entirely. When the soil becomes dry enough for agricultural purposes, then the verbenas, wild touch-me-not, asters, boneset, heartsease and many other wild flowers contribute to the autumn honey flow.

SOILS OF THE UPPER PENINSULA

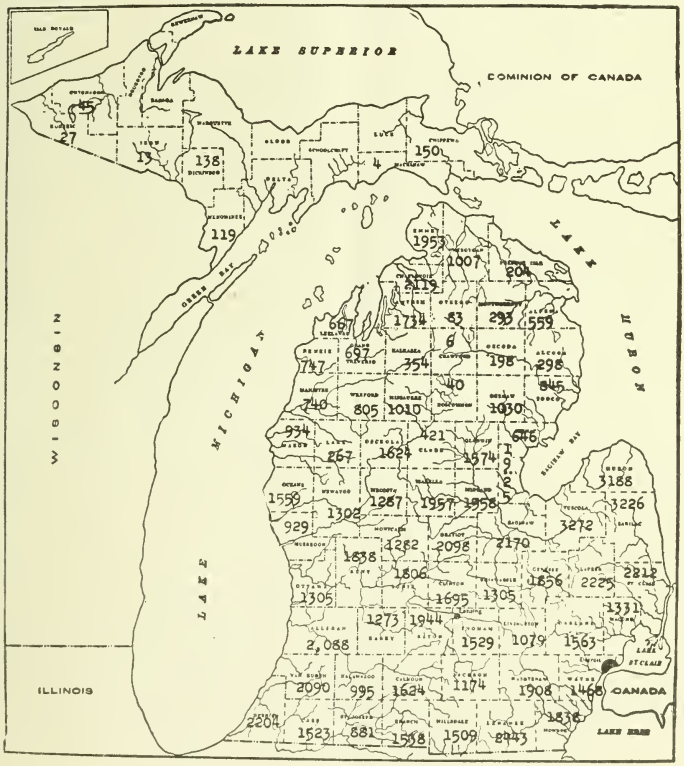
The lake clay soils which occur in Chippewa, Delta, Baraga, Houghton, Ontonagon and Gogebic Counties are the soils best adapted to the growth of alsike and white clovers. Those areas are now the great clover-hay producing areas of the Upper Peninsula. These soils generally lie flat, the water table being rather close to the surface. They almost never suffer for lack of moisture. This particular type of soil occurs in a formation covering quite large areas and therefore the possibilities for extensive beekeeping in such sections are very great. The lake clay soil areas are spotted somewhat with water washed sand and are largely surrounded by the morainic clay or sandy soils. On the lighter soils the wild red raspberry and minor honey plants grow in abundance. It is possible to secure a yield of nectar from the clovers, raspberry and other sources by placing the yards on the borders of the lake clay area. The lake clay soils should be considered as primarily white and alsike clover territories.

THE MORAINIC SOILS

These soils differ much in their formation, ranging from a loose, somewhat gravelly or sandy soil to a very heavy clay soil. The surface is usually rolling. The quality of the soil ranges from fair to very good. This soil supports a very good growth of clover. Raspberry is one of the conspicuous honey plants of this type of soil. On these areas there grows a larger variety of nectar secreting plants than on the lake clay area.

ROCKY SOILS

Part of the soils of morainic formation contain such large quantities of rock deposited by the glaciers that they are unfit for farming purposes. Also, a part of the rocky soils of the Upper Peninsula are due to the out-cropping of the underlying rock bed. The rocky areas of Marquette, Houghton and Keweenaw Counties are of interest to the beekeeper only in those districts where the wild red raspberry is abundant. Along the southern side of the peninsula a limestone out-cropping extends from the Canadian boundary westward into Wisconsin. In the more rugged parts of this area cultivation of the soil is impossible. Along the edge of the limestone formation there is agricultural soil which has wonderful possibilities from the standpoint of the production of the various clovers. In a part of this territory alsike and white clover are already growing in abundance. With the increasing interest in sweet clover beekeepers may well look with favor upon the more rugged limestone formations as an area on which a perpetual cropping of sweet clover



Map showing relative number of colonies of bees in the various counties in Michigan. These figures were taken from the census report and represent about one-half of the colonies owned within the State. This error is in the census because no inquiry is made in regard to bees in cities and towns. Most of our larger beekeepers live in cities and towns and operate their out-yards from their homes.

could be expected. Fortunately, much of the limestone formation lies adjacent to the morainic clay and the lake clay areas. Again the opportunities of migratory beekeeping are presented.

Sandy Soils. Part of the sandy soils, especially those of the highest quality, lie within the morainic clay areas. The larger part of the sandy areas are sand plains which are the outwash plains formed at the foot of the glaciers. Excepting the best quality of sandy soils, this type is not of interest to the beekeepers. It should be noted that the rocky, sandy and swamp soils are very much in the minority, as 65 per cent of the surface of the Upper Peninsula is agricultural land.

Swamps. The swamp areas are contained largely in Schoolcraft and Luce counties, although small swamp areas may be found in all parts of the Upper Peninsula. The swamps do not offer desirable locations for beekeeping excepting that in some years, aster, goldenrod, boneset, willow herb, and other nectar secreting plants appear in abundance. At such times the beekeeper could move his colonies there to take advantage of the late nectar flow. Willow herb is a conspicuous flower for several years after the swamps have been burned over.

CLIMATE OF MICHIGAN

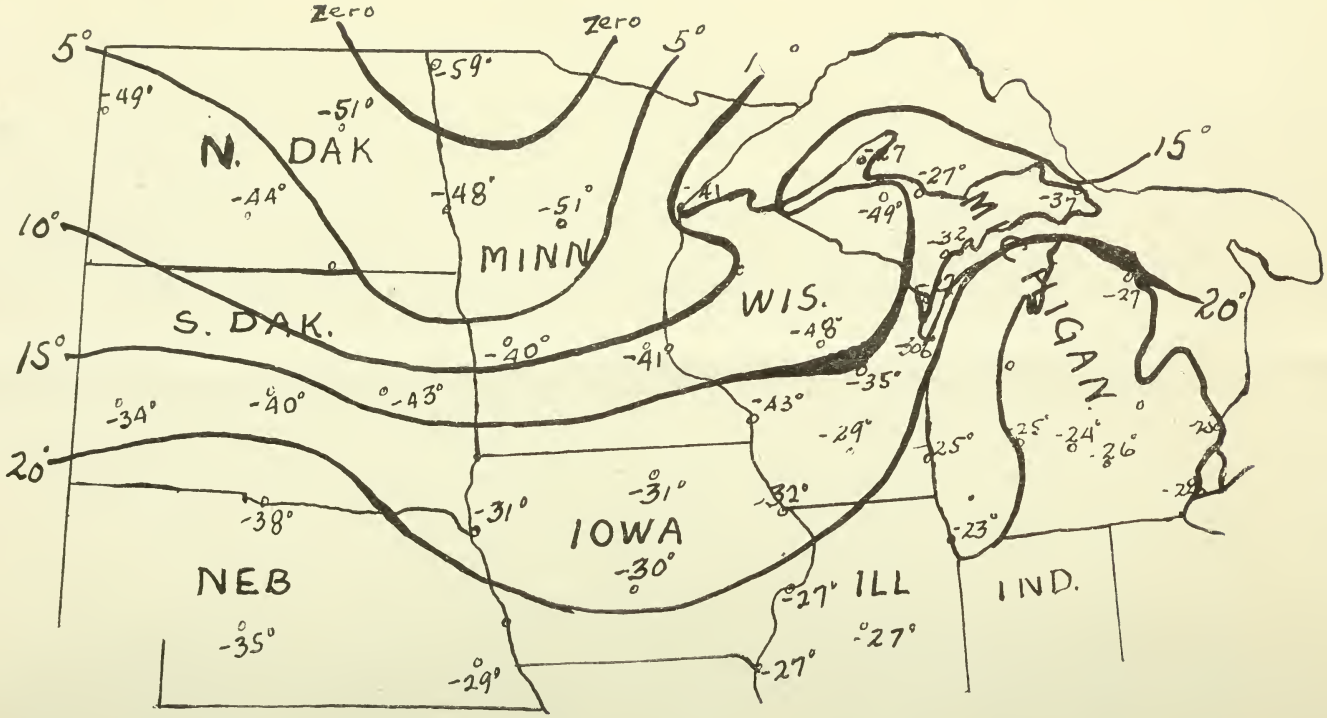
Temperature. As Michigan is almost surrounded by water, the climate is greatly modified by its influence. As shown in the accompanying map the mean temperature for the month of January in the Upper Peninsula is the same as in central and southern Wisconsin, northern Illinois, Iowa and northern Nebraska. The Weather Bureau records show that on the eastern shore of Lake Michigan in winter, the temperature is often ten degrees higher than at points directly across the lake in Wisconsin. In the summer the temperature on the Michigan side is correspondingly cooler than on the western side of the lake. It will be noted that during the winter the temperature along the Great Lakes is much higher than east or west of those points inland. The influence of the Great Lakes extends for many miles back from the shore. This should be particularly noted in the Upper Peninsula. The cool even temperature of winter is conducive to the health of all animal and plant life. While extremes in temperature are sometimes experienced in winter, most cold waves are very much moderated in passing over the great surface areas of the surrounding lakes.

The length of the growing season is determined by computing the number of days between the last killing frost in spring and the first killing frost in autumn. It should be especially observed that the area previously described as the sand plain area of the Southern Peninsula has the shortest growing season. In the Upper Peninsula that part which is farthest inland from the Great Lakes and where the surface lies the highest has the shortest growing season. It is particularly noticeable that for a number of miles back from

TABLE OF COMPARATIVE TEMPERATURES

Compiled by U. S. Weather Bureau, D. A. Seeley, Chief, East Lansing, Mich.

Name of station.	Mean temperature January.	Lowest on record.	Average length of growing season.
Upper Peninsula—Michigan:			
Soo Ste. Marie	15.0	—37	138
Marquette	17.0	—27	147
Humboldt	10.7	—49	79
Escanaba	15.5	—32	147
Menominee	18.1	—27	149
Houghton	16.4	—27	151
Lower Peninsula—Michigan:			
Lansing	22.8	—26	159
Detroit	24.3	—24	164
Grand Rapids	23.8	—24	164
Grand Haven	24.6	—25	165
Port Huron	22.5	—25	157
Alpena	19.0	—27	138
Wisconsin:			
Madison	16.9	—29	180
LaCrosse	15.9	—43	162
Milwaukee	20.5	—25	163
Green Bay	16.4	—36	153
Stevens Point	14.8	—48	124
Hancock	15.3	—35	132
Fond du lac	17.0	—44	150
Minnesota:			
Park Rapids	3.5	—51	122
Pembina	—2.4	—59	104
Duluth	10.4	—41	153
Moorhead	2.9	—48	132
Milan	10.5	—40	130
St. Paul	11.9	—41	159
North Dakota:			
Devils Lake	0.8	—51	121
Bismarck	7.0	—44	129
Williston	6.1	—49	119
South Dakota:			
Huron	10.8	—43	131
Pierce	17.9	—40	153
Rapid City	22.9	—34	143
Nebraska:			
Valentine	22.0	—38	132
North Platte	22.9	—35	151
Lincoln	22.6	—29	174
Iowa:			
Sioux City	19.4	—31	146
Charles City	15.5	—31	133
Des Moines	19.9	—30	171
Dubuque	18.6	—32	176
Davenport	21.4	—27	174
Keokuk	23.7	—27	200



Heavy black lines show mean temperature for January. Figures show lowest temperature on record at each station. Data compiled by U. S. Weather Bureau, D. A. Seeley, Chief, East Lansing, Mich.

shore, in circling the whole Upper Peninsula, the growing season is more than 120 days and near the shore where the lake influence is greatest the growing season is from 140 to 150 days, this being nearly equal to the growing season in the south central part of the Lower Peninsula.

The absence of extremely hot weather in summer and of extremely cold weather in winter is a matter of tremendous importance in beekeeping. The moderate heat in summer is sufficient to produce a very heavy flow of nectar but does not dry the soil excessively. This results in uniformly heavy honey flows of long duration—one of the outstanding characteristics in Michigan beekeeping. The cooler summers also cause the production of a very white mild flavored honey as compared with honey from the same sources produced where the temperature is higher. This feature of our climate insures very high grade honey. Outdoor wintering of bees is being successfully practiced in all parts of the State. Cellar wintering is also satisfactory in all sections.

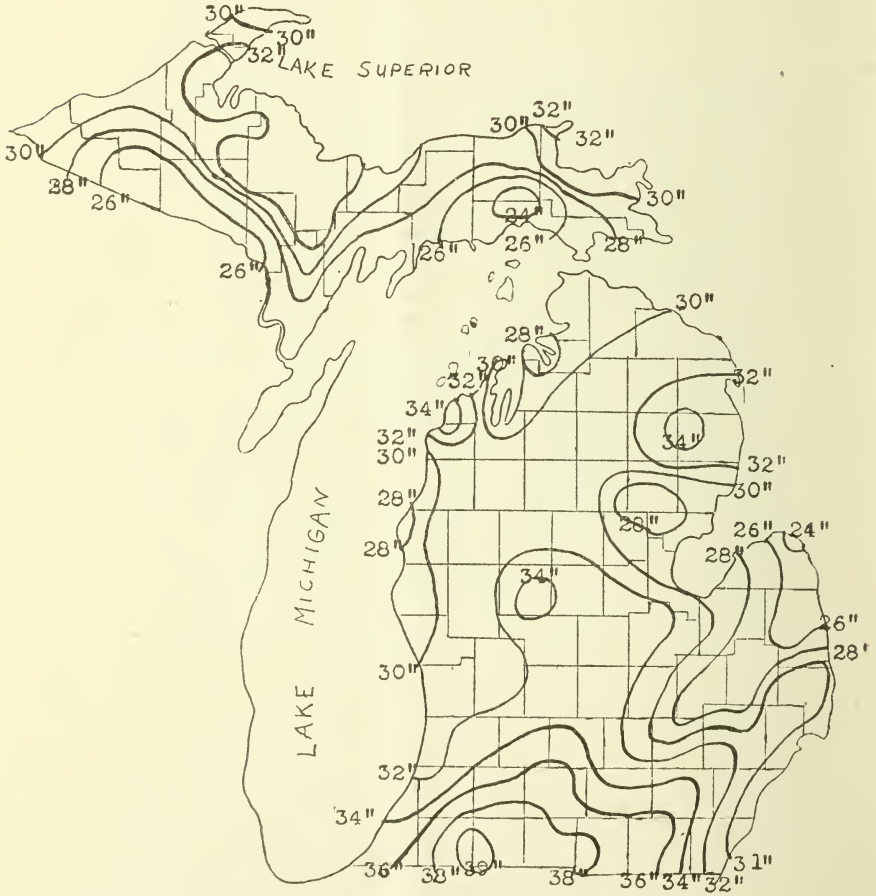
RAINFALL

The accompanying map shows that with the exception of two very small areas the average annual rainfall is more than 26 inches. It is a significant coincidence that those areas which receive the smallest amount of rainfall are so favored by soil and temperature that they do not need the heavy rainfall which is found in some other parts of the State. In the "Thumb" district of the Lower Peninsula where the rainfall is smallest, the soil is the surface of the old lake bed and withstands the lack of moisture exceedingly well. In the Upper Peninsula the excessive heat of southern latitudes is conspicuously absent. Cloverland, as the Upper Peninsula is commonly called, is particularly free from drought. The rainfall also is so distributed through the year so that the most rain falls at the time it is most needed. In the Upper Peninsula, during the months of May, June, July, August and September, the rainfall is three inches per month or more. During the rest of the year the amount of rain does not approach three inches and is only about one inch per month during January, February and March. The same condition holds true to a greater or lesser extent for the Lower Peninsula. It will thus be seen that Michigan is favored by having the greater part of its rainfall at the time that the crops are most in need of it. While the precipitation in winter is less than in summer, yet the ground in winter is usually well covered with a blanket of snow. Snow that falls in early December may not melt until in late March.

SUNSHINE

Michigan lies principally between the latitudes of 42° and 47°. While the length of the growing season becomes shorter in number of days with the distance from the equator, yet that is compensated for to a great extent by the fact that the hours of sunlight each day are greater than farther south. During the longest days of summer there are 15½ hours of daylight in the Upper Peninsula. In the vicinity of Lansing there are only 15 hours of daylight and in the states farther to the south of us the number of hours of daylight

are correspondingly less, so while the growing season of 120 days for example might seem short to some, yet the added hours of daylight in reality makes the season much longer. A growing season must be measured in hours of sunlight as well as in number of days. Atmospheric conditions are such that the number of cloudy days during the summer is very small outside of the time when rain is actually falling. The very high per cent of the possible hours of sunshine is one of the factors which results in such rapid plant growth in the Upper Peninsula. It has been amply demonstrated that the light of twilight and dawn is sufficient to cause plant growth. In the summer, during the long days, twilight may continue until ten o'clock at night and dawn is evident before three o'clock in the morning. With favorable temperatures and rainfall, plant growth may be much greater per day than in the states along the Gulf of Mexico.



Map showing average annual rainfall in inchs. Courtesy U. S. Weather Bureau, E. Lansing, Mich.

EFFECT OF THE CLIMATE ON THE QUALITY OF HONEY

It is a well established fact that many of the plants which yield a dark honey in the warmer southern states yield a much lighter colored honey in the north. The honey from white clover south of the Ohio River may grade from light amber to amber in color. Our favorable latitude together with desirable climatic conditions causes our honey to be of exceptionally light color. In those parts of the United States where the atmosphere is humid the honey seems to contain a higher per cent of moisture than in the drier climates. While Michigan can not be considered a dry climate, yet the absence of undue humidity between rains gives the bees an opportunity to thoroughly evaporate the nectar. Michigan honey has long been famous for its very light color and heavy waxy body. Michigan honey frequently commands a price of from three to eight cents per pound higher than honey from the same source in less favored states.

THE UPPER PENINSULA AS A BEEKEEPING LOCATION

Parts of the Upper Peninsula have been devoted to farming for more than sixty years. In many of the counties there are old settled localities that remind one of the farming districts of the states to the South and East. In such places schools, churches and roads are of the very best. There are many thriving cities which furnish adequate markets. Among these might be named:

Bessemer	5,500	Iron Mountain	9,200
Calumet and vicinity	40,000	Ishpeming	12,500
Crystal Falls	3,500	Manistique	6,400
Escanaba	13,200	Menominee	9,000
Houghton	5,200	Munising	5,000
Hancock	9,000	Marquette	15,000
Ironwood	15,700	Negaunee	8,500
		Soo Ste. Marie	12,700

Until within recent years lumbering and mining have been the chief industries of the Upper Peninsula. As long as timber was abundant little thought was given to agriculture. The result is that, with the exception of a few of the older settled tracts, agriculture is a new pursuit. Since most of the Peninsula has been lumbered off, and much of it many years ago, there are today tremendous areas of fertile cut-over land on which a furrow has never been turned. In some places a second growth of timber has come on. In other places the fires have destroyed all of the smaller trees and seedings. Where the fire damage has not been too severe, the clovers and raspberries have survived. These plants sometimes cover areas of many townships.

Beekeepers in southern Michigan, Wisconsin and Minnesota supply the Upper Peninsula with practically all of the honey that is sold there. From

a marketing standpoint the territory is unsurpassed. The Upper Peninsula must not be thought of entirely as a pioneering or home-steading country. The people have wealth and culture. There are many farms as modern as any in the State. The buying power of the population is above the average.

Beekeepers seeking new locations can find anything they desire from the typical American city to the sparsely populated areas of the grazing or cut-over lands. Villages and small towns are scattered at convenient intervals throughout the Peninsula. The beekeeper who desires to live in a town where he and his family may enjoy social and educational advantages can easily find such a desirable place with unlimited beekeeping territory conveniently near. The wonderful system of State roads for which Michigan is justly famous is rapidly linking together all the larger cities and towns.

Nearly all of the bees in the Upper Peninsula are wintered out of doors. All of the larger beekeepers prefer packing the bees outside. The great blanket of snow which covers the Peninsula in winter protects the colonies from the winds and from the cold. When it is known that the soil of the Upper Peninsula during many winters is not frozen and that potatoes are often dug in the spring instead of in the fall, then the beekeepers of farther south will understand why bees can be perfectly wintered outdoors.

Someone has said that there are only two seasons in the Upper Peninsula—winter and summer. Springtime is of short duration. The long hours of daylight push the plant growth with a rapidity never witnessed even in southern Michigan. Bees build up with extreme rapidity. The honey flow opens in June and continues for the most part until the frosts in autumn kill the flowers. Comb honey is produced on the shores of Lake Superior. Extracted honey production is more general and is much more profitable than comb honey production. It must be remembered that for maximum crop production these factors must be present in a beekeeping location: Ample rainfall, a rich soil which is retentive of moisture and adequately supplied with lime, favorable temperature, the maximum amount of sunshine and daylight and no excessive humidity. All these essentials are present to a remarkable degree on all the better types of beekeeping soil throughout the State.

AGRICULTURAL CONDITIONS IN THE LOWER PENINSULA

The southern half or more of the Lower Peninsula does not differ materially from the older settled states. Agriculture is highly developed. Cities and towns are numerous, State roads have been built and are well kept up. Everything that characterizes an intelligent and prosperous country is present.

The northern part of the Lower Peninsula and the Upper Peninsula is the great summer play ground of the Central States. With its thousands of lakes and trout streams, with a climate that is unexcelled and because of the absence of hay-fever and asthma, thousands of people from adjacent states flock to Northern Michigan for the summer. The summer tourist is the beekeeper's opportunity which at the present time he is not recognizing. The beekeepers of this region could build up a tremendous trade in honey to be shipped later by parcel post or otherwise to the homes of the summer visitors from other states.

There are great areas throughout the upper half of the Lower Peninsula where very little farming is carried on. The clovers, milk weed, fire weed,

and raspberry often grow in considerable areas beyond the range of the present beekeepers of that region. While there are districts in which beekeeping is carried on in a commercial way, yet the unoccupied territory is probably in excess of that which is occupied.

In the southern half of the Lower Peninsula there are also many unused locations. There are, however, many thousands of beekeepers widely scattered through this district. See map on page 7 showing colonies of bees by counties. The opportunity for a new good location is in the northern part of the Lower Peninsula and in the Upper Peninsula.

The markets of the Lower Peninsula are excellent. Ninety per cent of Michigan's honey crop is consumed locally or sold to merchants or housewives without passing through the hands of the wholesaler. Detroit, the fourth city in size in the United States and having a population of over one million, could absorb all the honey that goes into the wholesale trade in addition to what is already being sold there. Consider the potential buying power of the following cities in the Lower Peninsula:

Ann Arbor	20,000	Jackson	48,374
Battle Creek	36,164	Kalamazoo	48,858
Bay City	60,000	Lansing	57,327
Detroit	1,050,000	Muskegon	36,570
Flint	91,599	Pontiac	34,273
Grand Rapids	137,634	Port Huron	25,944
		Saginaw	65,648

NECTAR SECRETING PLANTS

The following are the chief sources of nectar in Michigan:

White Honey	*Light Amber or Amber Honey*
Alsike clover	Golden rod
White clover	Spanish needle
Wild red raspberry	Buckwheat
Milk weed	Boneset
Fire weed or willow herb	Fruit bloom
Sweet clover	Dandelion
Basswood	Heartsease
Alfalfa	Cucumber
Canada thistle	
Asters	
Verbena	
Mints	
Blackberry	
Maples	

Alsike and White Clover. Both of these clovers are ordinarily found in the same territory. The alsike clover, however, is particularly adapted to the low lying heavy soils of the old lake bed. Both clovers are found in abundance wherever the quality of the soil is such as to be good farming land. Alsike is more tolerant than white clover in that it makes a good growth on

soils somewhat deficient in lime and insufficiently drained. In the days of the lumbering industry the alsike clover seed was scattered along the logging trails through the hauling of hay. Today alsike clover is found growing wild in almost unbelievable quantities throughout the cut-over lands wherever the soil is good. These two plants constitute the chief sources of nectar in Michigan. In the Upper Peninsula and in the northern part of the Lower Peninsula there are thousands of acres of alsike clover growing wild with no bees near enough to gather any of the nectar. The number of colonies in the alsike districts of the whole State could be increased to five times their present number without crowding. Alsike and white clover produces a heavy white honey of the very best flavor. It is this honey that has contributed largely to making Michigan famous for its high grade honey.

Red Raspberry. A heavy growth of red raspberry followed the cutting of the timber, chiefly on the hard wood lands. When undisturbed by fires the raspberry grows in such profusion that it is almost impossible to penetrate the thickets. Raspberry blooms about two weeks previous to the beginning of the alsike bloom. The two honey flows frequently overlap. The honey is light in color, mild in flavor and is very much sought after because of its excellent quality. The growing scarcity of raspberry honey places the beekeeper in raspberry districts in a position where he can demand and receive several cents per pound premium over the price of other honeys.

Fire Weed or Willow Herb. This plant was at one time quite common as far south as Lansing. It cannot withstand civilization and so is found today in areas of importance to beekeeping only on the cut-over lands and swamps of the northern part of the State. Following the forest fires, willow herb springs up and gives an excellent flow of water-white honey of the finest quality for several years. As the raspberry and other plants become re-established the fire weed gradually disappears until the advent of another fire.

Milk Weed. Milk weed is a major honey plant in a rather restricted area in Cheboygan, Emmett, Charlevoix, Antrim, Grand Traverse and Leelanau Counties and to a lesser extent in counties east and south. The milk weed territory is growing larger year by year as the seeds are carried very readily by the wind. Milk weed honey is a very light amber which passes on the markets for white honey. It is very rich in flavor, has a very heavy body and is considered one of Michigan's best honeys.

Sweet Clover. Sweet clover has become important as a honey plant only within recent years. With the advent of the annual white sweet clover a new interest is being taken in its cultivation. Sweet clover seed is being produced in a large number of the counties. Sweet clover is most popular on the lighter soils and is being advocated by County Agricultural Agents as a means of building up the sandy soils and other soils that have been worn by cropping. Probably every county in the State is growing some sweet clover and the acreage devoted to it is bound to become larger year by year. The sub-divisions lying at the outskirts of our cities are frequently covered with a growth of sweet clover which forms a valuable source of nectar for the city beekeeper. Sweet clover honey ranks with the other clovers in quality. It has a greenish tinge and a mild aromatic flavor.

Basswood. Basswood has been one of the major sources of nectar in Michigan. However, the basswood timber has been removed to such an extent that there is very little, if any, pure basswood honey produced. The bass-

wood flow comes at the latter part of the clover flow or immediately following it and practically all of the basswood honey is therefore mixed with the clover. It is a light honey with a strong aromatic flavor and is considered of highest quality.

Alfalfa. When alfalfa is planted on a light soil and when the summer is inclined to be rather dry and hot, the bees frequently work the alfalfa bloom with considerable energy. Beekeepers have from time to time reported the storing of considerable surplus from this plant. The seed bearing alfalfa which is being developed at the Agricultural College will likely be our most important source of alfalfa honey.

Canada Thistle. This plant is scattered to a greater or lesser degree throughout the State. In some sections it grows so abundantly as to interfere with the growth of other plants. It does not always yield nectar in paying quantities. If the weather conditions are suitable a yard of bees situated in a good Canada thistle territory may store a quantity of honey sufficient to place it among the major honey plants. The honey is white in color and of very good flavor. This honey is often mixed with the clover honey and sells as such without anyone realizing that half or more may be from Canada thistles.

Asters. In the southern half of the State the asters grow principally in the swamp lands. In the northern part of the Lower Peninsula and in the Upper Peninsula, asters are frequently found in abundance on the higher soils. With satisfactory weather conditions they yield a tremendous crop in a very short time. A yield of 200 pounds of surplus per colony in 20 days has been reported from the Upper Peninsula. The honey is light in color and when well ripened is of good body and flavor. However, when weather conditions do not permit of the proper ripening of the honey, then the flavor is strong and unpleasant.

Verbena. The verbenas grow on the rather low pasture lands and swamps. They are of principal importance in the southern one-third of the Lower Peninsula. The honey is in quality equal to clover and is commonly considered as such on the market.

Mints. Michigan is the largest producer of mint oils of any of the states. The mints are grown chiefly in the southern parts of the State in the counties of Allegan, Cass, Berrien, Kalamazoo, Van Buren and St. Joseph. On many of the large marshes it is not possible to cut the whole acreage for distilling until after the blossoms have opened, and so the bees frequently secure a considerable amount of surplus honey. The mints are grown chiefly on the reclaimed swamp lands. Beekeepers in the vicinity of the mint marshes usually secure some mint honey which is white in color and has a very delicious, spicy flavor.

Blackberry. Blackberries like the wild red raspberries grow principally on the cut-over lands of the northern part of the State. They frequently grow in abundance on marshes and on soils that are lighter than those on which the raspberry does best. The blackberry is not of such importance as the red raspberry, but there are thousands of acres of this plant in northern Michigan that would be a valuable source of nectar if there were bees there to gather it. The honey is white in color and of very agreeable flavor.

Maples. The maples are found growing on the better soils throughout the whole Upper and Lower Peninsulas. They are not particularly of value for surplus honey, but they frequently furnish an abundance of nectar for brood rearing in the spring time when no other source is available. Because of their value in supplying the food for producing a large colony of bees for the later honey flow, the maples are considered by all of our beekeepers to be a very valuable asset.

Cucumbers and Related Plants. There is a great number of salting stations scattered through the Lower Peninsula. Around all of the salting stations there is grown a considerable acreage of cucumbers. Beekeepers who have apiaries within reach of the cucumber fields find that they secure a considerable amount of very desirable honey from the cucumber bloom. Squashes and melons are also of value where grown in a sufficient quantity. The blooming period is midsummer and later. The honey is light amber in color and of mild and pleasing favor.

Goldenrod. Taking the State as a whole, golden rod is considered to be our most valuable source of fall honey. In the northern two-thirds of the Lower Peninsula, and in the Upper Peninsula, golden rod is looked upon as an almost unfailing source of nectar. There are many varieties, some of which do not seem to be of any particular value. The distribution of the nectar secreting golden rods is so general that beekeepers in practically all locations secure at least some surplus golden rod honey. Even though it furnishes many tons of desirable honey, yet its greatest value lies in the stimulating of brood rearing during the fall months. A golden rod territory insures good sized colonies of young bees for the winter cluster. The honey is a pure gold in color. The flavor, while more pronounced than in the clovers, is mild and agreeable.

Spanish needle. Spanish needle constitutes a major source of nectar in the southern one-third of the Lower Peninsula in those areas where the swamps have not been drained. As the swamp lands are reclaimed, Spanish needle disappears. It is as yet a very valuable source of nectar in nearly every county in the southern part of the State. Fortunately for the beekeepers, there is an infinite number of small swamps which are so situated that it is impractical to drain them because of the expense involved. In such places Spanish needle will doubtless continue to be a major honey plant. The honey is amber in color and of rather strong flavor. Pure Spanish needle honey is not often found as golden rod, verbena, heartsease, boneset and buckwheat all bloom at about the same time. The fall honey in the southern part of the State is usually a combination of most of the above sources. This honey is of a very agreeable flavor to those who have a taste for the darker, stronger flavored honeys.

Buckwheat. Buckwheat is a common crop on the lighter soils in all parts of the State. The nectar is secreted in early autumn after the white honey flows are over. When found pure, it is dark amber in color and strong in flavor but very pleasing to a part of our population.

Boneset. Boneset grows in swamps and marsh lands in all parts of the State. It is not considered by beekeepers as a very good source of surplus honey but is valued by them for its influence in keeping up brood rearing at a time when other nectars are scarce. It is a very dependable source of nectar. The honey is rather dark and of unpleasant flavor.

Fruit Bloom. Michigan is famous for the wonderful fruit belt which lies on the western side of the State within the influence of Lake Michigan. Within this fruit belt apple, peach, plum, cherry and the smaller bush and vine fruits are grown in places almost to the exclusion of other crops. During the blooming time they furnish an exceedingly valuable source of nectar. Surplus honey is not usually stored from the fruit bloom as the blossoms come early and the colonies are not usually up to storing strength. It furnishes, however, the food which is so essential to getting the colonies in proper condition for the clover and later honey-flows. To the eastward beyond the limits of the fruit belt proper, there are many farm and commercial orchards. The smaller orchards are not confined to the Lower Peninsula alone but are found as far north as the shores of Lake Superior. The presence of a goodly acreage of orchard is a valuable asset to any beekeeper.

BEEKEEPERS' ORGANIZATIONS

Michigan Beekeepers' Association. This is one of the oldest if not the oldest, beekeepers' organization in the central states. It was organized in 1865 and has upon its list of members some of the country's greatest exponents of good beekeeping. The names of Hutchinson, Bingham, Hilton, Heddon, Benton, Cook, Townsend and many others, all Michigan men, are household names among the beekeepers. The association all through the years of its existence has taken the lead in directing the policies in education, marketing, inspection and kindred interests of the beekeepers as a whole. There are now about 700 active members. The annual meeting is held each winter in the city of Lansing. A summer meeting is held in northern Michigan. Mr. R. H. Kelty, E. Lansing, Mich., is secretary.

STATISTICS RELATIVE TO MICHIGAN BEEKEEPING

It is estimated that there are from ten to fifteen thousand beekeepers in the State operating from 150,000 to 200,000 colonies of bees. The product of the bee is about 8,000,000 pounds of extracted honey, 2,000,000 pounds of comb honey and about 150,000 pounds of bees wax. As Michigan honey is of very high grade, it brings the top price on the market. The value of the apiary products, aside from the colonies of bees and the queens that are sold, is nearly $2,000,000.

APIARY INSPECTION

The work of Apiary Inspection has been carried on for a number of years. Complete data is available as to the distribution of the bee diseases in Michigan. Two inspectors give their entire time to the work and about fifteen beekeepers in various parts of the State give varying amounts of their time to inspection work during the summer. Because of the lack of funds, it has been impossible until within the last two years to undertake a compaign of eradication of bee diseases from any of the infected districts of the State. A program is now being followed which it is believed will in time with more liberal financial assistance result in the bee diseases being crowded out of the State.

Apiary inspection is a part of the Michigan Department of Agriculture, Lansing, Mich.

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Tips and Pointers

ON SUCCESSFUL BEEKEEPING.

AMERICAN FOUL BROOD

BY

B. F. KINDIG,
Director Apiary Inspection

JAN 22 1926

BULLETIN No. 2
October 20th, 1921

MICHIGAN DEPARTMENT OF AGRICULTURE
LANSING, MICHIGAN

H. H. HALLADAY, - - - - - Commissioner
FRED L. WOODWORTH, Director, Bureau Foods and Markets, Deputy Commissioner
JOHN A. DOELLE, - - Director, Bureau Agricultural Development
HORACE W. NORTON, Jr., - Director, Bureau of Animal Industry
T. H. BROUGHTON, - - - - Director, Bureau of Dairying

The industrious bee creates about $1,500,000 for Michigan annually.

Mr. B. F. Kindig, Inspector of Apiaries, has condensed the information concerning the most serious disease of the bee in a manner which will aid the beekeeper to recognize the disease and eradicate it.

JOHN A. DOELLE,
Director, Bureau of Agricultural Development.

American Foul Brood is an infectious disease of the larvae of the honey bee. It is quite generally distributed throughout the southern peninsula of Michigan with the exception of the northeastern quarter.

CAUSE

The disease is caused by a microscopic organism similar in appearance and habits to some of the germs which cause disease in the human body. The organism is known as *Bacillus larvae.*

SYMPTOMS

To the beekeeper who is unfamiliar with this disease, usually the first symptoms apparent are a gradual weakening of the colony and the presence of a very unpleasant odor in the hive. In the very early stages of the disease it is recognized by an occasional brood cell capping being sunken and darker in appearance than the cappings of the adjacent cells. A part of these cappings may also have small holes in them, often ragged in appearance. Upon further examination it may be found that in a few uncapped cells the larvae have died and are decaying on the lower cell walls. Upon careful examination, the dead larval remains in all of the cells just mentioned will be found to be similar in shape and position, although they may vary somewhat in color. Soon after the death of the larva it begins to take on a brownish appearance and the longer the larva has been dead and the more it becomes dried down the darker is the color. When the remains have dried down to a thin scale on the lower cell wall the color becomes almost black. When larvae die from this disease the decayed remains tend to become quite gluey in their consistency. If a match or tooth-pick be inserted into the cell and a part of the remains drawn out it will be found to stretch out somewhat like glue. This quality is commonly spoken of as ropiness and is often considered the diagnostic symptom of this disease. However, in making a diagnosis these four factors should be present:

(1) The larvae should lie on the lower cell wall.

(2) The color should be brown or black.

(3) The consistency of the larvae should be ropy unless dried down into a black hard scale.

(4) The odor should be repulsive, inasmuch as it is commonly described as smelling like a glue pot.

Even in a very mild case of disease the first three symptoms should be apparent while the fourth (the odor) may not be so noticeable if only a few cells are affected. Whenever there is the slightest doubt as to the diagnosis of disease a sample of the comb containing the diseased larvae should be sent to this office, where a microscopic examination will be made. Upon application, the department will gladly furnish a mailing case for sending in samples of comb for disease identification.

TREATMENT

The only successful treatment for American Foul Brood consists in removing the bees from the combs and hives and placing them in a clean hive without combs but in which the frames are fitted with full sheets of foundation. There are slight variations in the method of treatment according to the season of the year. These slight differences will be fully discussed under the method of treatment for the particular season. If it is at all possible to avoid it, a diseased colony should never be treated in the same yard with colonies that are not diseased. Wherever possible, the diseased colonies should be removed a mile or more from the yard, given the proper treatment and then returned to the yard. Whenever treating for disease one should give due consideration to the location of other beekeepers in order that disease may not be spread by robbing during the process of treatment.

SPRINGTIME TREATMENT

When it is desired to treat the bees as early in the spring as possible and when more than one colony is diseased, it is possible to save the brood of each colony excepting the last one treated by the following plan:

Pick out from among the diseased colonies the ones which are deemed strong enough to stand the shock of treatment during the month of May. Each of these colonies should be transferred into clean hives with full sheets of foundation and the brood which they had should be placed on one or more of the weaker diseased colonies. In the process of transferring, the diseased colony is placed two feet or so to the back or side of where it formerly stood. The hive into which it is desired to transfer the bees is placed on the old stand. After placing a newspaper in front of the hives to catch any honey that may drip, then taking one frame at a time the bees should be brushed upon the paper in front of the new hive. Care should be used to see that the queen enters the new hive. After she is in, a queen-guard or queen and drone trap should be placed on the entrance to prevent the swarm from absconding. After all the bees have been removed, the combs may be placed on another diseased colony as said before. If only one colony is affected, then the combs should be buried deeply or burned. In all of the manipulations concerned with the handling of disease every precaution must be used in order that no robbing may take place. If any robbing occurs it is quite certain that each colony concerned in the robbing will later become diseased. For this reason it is customary to treat diseased bees late in the evening after the bees have quit flying. If it is necessary to treat them in a yard where there are healthy colonies, then the entrances to all of the adjacent healthy colonies should be closed with a screen so that in the excitement and confusion incident to transferring if any of the bees from the diseased hive attempt to enter they will be unable to do so. If it is impractical to move the bees from the yard for treatment, then the hives should be moved a foot or more each day until the diseased hives are as far as they can be placed in the yard from other colonies. Many beekeepers who have treated disease from year to year find it advisable to use a screened cage about six feet

square and six feet high. They perform all of the work of transferring within this cage. In this way it is impossible for robbers to enter or for any of the bees of the colony to enter another hive. Whenever bees are disturbed as in transferring they fill their honey sacs with honey. In case it is a diseased colony the honey which they carry may transmit disease to any colony which such bees may enter. It is, therefore, very essential that all of the bees of a diseased colony be kept together. Colonies which are strong enough to admit of treatment in the month of May should build up and store a satisfactory amount of honey during the following honey flow.

SUMMER TREATMENT

Weak colonies on which the brood was stacked from the colonies treated in May, or other colonies which were too weak for treatment at that time should be treated during the first few days of the main summer honey flow which in this State is either the raspberry or clover flow. The same method of treatment should be followed as described previously, excepting that in case some colonies are not strong enough at that time to produce surplus honey, then, two or more colonies should be united at the time of treatment. It is not advisable to handle colonies in such a way that the surplus honey crop is entirely sacrificed. If an increase in the number of colonies is desired, it can be made in the latter part of the clover flow with but very slight sacrifice in the honey crop. The brood from five or six treated colonies can be piled upon one diseased colony and after three weeks when all of the brood is hatched, then the remaining colony should be treated. Whether or not all of the colonies are to be treated at the beginning of the main honey flow is optional with the beekeeper. If they are all treated at that time all frames containing brood must be burned or buried at once. If some of the diseased colonies are still weak it is probably best to pile the brood from those that are strong enough on them and arrange to treat three weeks later. However, when treatment is delayed until three weeks after the beginning of the honey flow in some instances not sufficient time is left for them to store honey enough for their needs. In this case they will have to be fed later.

FALL TREATMENT

It occasionally happens that a colony which becomes infected in the spring may not be discovered until after the clover honey crop has been gathered. In general, it is not advisable to treat bees when there is no honey flow. The danger of robbing under such conditions is very much greater and feeding must be resorted to in order to keep the colony alive. Late cases of infection may be treated during the month of October after brood rearing has practically ceased. The method of treatment is the same as described before, excepting that the bees are transferred into a hive without frames. They should be left in this hive for at least 48 hours. At that time the beekeeper should carefully remove the hive body from the bottom board. A hive body full of combs of honey taken from a healthy colony should be set in its place. Then the empty hive

body with the bees should be set on top and jarred slightly. The bees will then take possession of the combs and honey and the empty hive body may be removed.

FEEDING IN CONNECTION WITH TREATMENT

When it is desirable to treat very early in the season it is occasionally necessary to resort to feeding in order to get the foundation drawn out and to get brood rearing under way as quickly as possible. Realizing that the bees carry with them a supply of honey which is sufficient for their food for several days, it is not necessary to do any feeding until from two to three days after treatment. It is very fortunate that in the digesting of the disease carrying honey which the bees have in their honey sacs at the time of treatment, all danger of disease is eliminated. When bees are placed on foundation they very rapidly use up the honey which they have with them in the secretion of wax for comb building. For this reason it is not advisable in treating disease to give the colony a set of drawn combs. When this is done they deposit the honey which they carry with them in the cells and part of it is fed to the young larvae which they proceed to rear. Thus the disease which was present in the old hive is continued in the new one. When it is necessary to feed, the use of a Boardman entrance feeder or an Alexander bottom board feeder is very convenient. If these are not at hand a very efficient feeder can be made by punching a number of fine holes in the lid of a friction top pail. This should be filled with syrup and inverted directly over the frames. The bees will then suck out the syrup.

DISPOSAL OF WAX AND HONEY

Where only a small number of colonies are treated the best means of disposal of the frames and honey is to burn or bury them. In cases where a large yard is quite generally diseased it then becomes advisable to save as much of the equipment as possible. After the brood has been allowed to emerge as previously mentioned, then the hive bodies of combs should be removed to a bee-tight building. There the honey should be extracted at once. The honey may be used for making honey vinegar. A bulletin on the subject of making honey vinegar can be secured from the Department of Bacteriology, Michigan Agricultural College, East Lansing, Michigan. It is not desirable to sell this honey as it may be exposed by the purchasers in such a way that bees may secure some of it and thus carry the disease to their own hives.

After extracting, unless a very cold cellar is available for storing the combs, it is necessary to cut the combs out and melt them at once because of the danger of wax moths at that season. No one should ever attempt to ship diseased combs to a foundation factory for rendering, excepting during the months of December, January and February. When combs are packed in a barrel and shipped, very often honey leaks out upon the floors of the cars or in the freight houses and becomes accessible to the bees of the vicinity. This practice is forbidden by law in most States including Michigan.

After disposing of the combs and honey the frames should be boiled for not less than five minutes in a solution made from one can of concentrated lye to six gallons of water. Before placing the frames in this solution the wax and propolis should be carefully removed. After boiling, the frames should be thoroughly rinsed in a tub of clear, warm water. The hive bodies, super covers and bottom boards, should be thoroughly scraped to remove all particles of wax, honey and propolis. Then they should be gone over with a flame of a blow torch and the surface scorched until no germs can remain alive. Ordinarily supers and hive bodies are more easily sterilized by piling them up-side-down as high as one can conveniently reach and burning a small handful of straw or paper on the inside. Care must be exercised else the whole pile of supers will be burned up. A hive cover should be convenient for putting over the top to stop the blaze.

It must be realized that there is grave danger in the handling of diseased material unless every precaution is taken to prevent robbing. The extractor should be thoroughly scalded out after extracting diseased honey. If possible the extractor should be taken to where it may be turned up-side-down and a steam hose turned into it with considerable pressure for at least 15 minutes. If the wax is rendered, the slumgum and the water used in wax rendering should be buried after the bees have quit flying in the evening. All vessels or tools which come in contact with the disease must be thoroughly disinfected. If the above directions are followed carefully much valuable material may be saved. If not, Foul Brood will be scattered far and wide over the adjacent territory.

METHODS OF SPREAD

American Foul Brood is commonly spread through carelessness on the part of someone. If carelessness on the part of beekeepers could be eliminated the problem of controlling Foul Brood would be very much simplified. Weak diseased colonies may be robbed out because the entrances have not been contracted to a point where they can defend themselves. Dead diseased colonies are robbed out because the beekeeper carelessly leaves such colonies exposed in the bee-yard. It is a beekeeper's business to know whether any colonies are dead or weak, and it is his business to take care of them so that they may not be a menace to the neighboring beekeepers. The careless exposure of disease carrying honey and the like is criminal and the offender should be punished by nothing less than confinement in the county jail. Often honey houses and other places where diseased honey and combs are stored have cracks in the doors or windows or the siding does not fit properly and whatever is contained therein is exposed to all of the bees in the territory. Often hives in which the colonies have died from disease are sold either through ignorance of the seller, or as has been amply demonstrated, because his sense of right and justice has never been properly developed. A careful survey of conditions in Wisconsin showed that a large part of the spread of foul brood was directly traceable to the selling or moving of diseased hives or equipment. The feeding of honey, a part of which was extracted from a diseased colony, causes an outbreak of disease wherever such honey is fed. Therefore, this department never advises

the feeding of honey. It is not always possible to know whether or not some of it may have come from a diseased hive even though no disease is known to be in the bee-yard. Some of the honey in the yard may have been stored from honey robbed from a diseased colony in the neighborhood.

BEE YARD SANITATION

The bee-yard practice must be such as to prevent robbing.

Frames of honey should not be taken from one colony and given as food to another colony.

A diseased colony should never be opened when there is the slightest danger of robbing.

Diseased colonies should be removed from the yard as soon as discovered and treated before returning them.

Carelessness, ignorance and malice are at the bottom of most of the spread of disease.

Do not use equipment from an unknown source without seeing to it that it can not carry disease.

When a colony shows disease every frame connected with that colony must be destroyed. Some have erroneously judged that those frames which do not have dead larvae in them are suitable for further use.

In purchasing bees buy them in combless packages, not on drawn combs, unless there has been no disease among the bees for at least one year. The selling of diseased bees has contributed largely to the spread of disease in Michigan.

Every super and every frame should be numbered to correspond with the hive on which it belongs and should be used there and nowhere else. If this suggestion is followed, extracted honey producers will find that foul brood is just as easy to control in their yards as in the yards of comb honey producers.

Apiary inspection which was formerly administered from the Agricultural College is now a part of the State Department of Agriculture. All of the employes are giving their time to the work throughout the year. With this new arrangement more effective work will be possible and a greater service will be given to the beekeepers of the State. The Bureau of Apiary Inspection of the Department of Agriculture, Lansing, Michigan, will be very glad to correspond with you and help you in every way possible in the control of bee diseases.

LAWS RELATIVE TO FOUL BROOD

Section 4. If the owner, possessor, agent or lessee of an apiary, honey or appliances, wherein disease is known to the owner, possessor, agent or lessee to exist, shall sell, barter or give away or remove from the premises, without the consent of the inspector, any bees from diseased colonies, be they queens, drones, or workers, honey or appliances, or expose other bees to the danger of such disease, said owner shall, on conviction thereof be punished by a fine of not less than ten dollars or more

than fifty dollars and costs of prosecution: Provided, That bees may be shipped without honey or feed containing honey, also provided that honey may be sold in tight containers for commercial purposes, other than with bees or as food for bees.

Section 9. It shall be the duty of any one keeping bees in the State of Michigan, to deeply bury combs and frames taken from diseased colonies, in places where they shall remain undisturbed, unless they be placed in tight receptacles so constructed that it shall be impossible for bees to gain access to combs, or for honey or any other liquid to leak out where bees can gain access to it. Anyone knowingly exposing comb, honey, frames, quilts, empty hives, covers or bottomboards, or tools or other appliances contaminated by infected material from the same, from diseased colonies, shall on conviction thereof, be punished by a fine of not less than twenty-five dollars, nor more than fifty dollars: Provided, That the wax may be rendered in such places or at such time that no bees will be able to gain access to the comb before it is thoroughly heated, or at any time to the liquids expressed in the process of rendering.

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JUL 31 1922

ON SUCCESSFUL BEEKEEPING.

REQUEENING THE APIARY

BY

P. T. ULMAN

Apiary Inspection

BULLETIN No. 3
January 30th, 1922

Requeening the Apiary.

Michigan has many localities where European foul brood is securing a stronghold and is discouraging the beekeepers of those sections.

The Apiary Division of the Department of Agriculture considers European foul brood the problem of the individual beekeeper and not one for the inspector, except as he may be able to give information for its control, yet the control of this disease is so closely associated with pure Italian bees and young queens that it was deemed advisable to write this circular.

The purpose of this article is to enable the beekeeper to rear his own queens, and is not intended to supply the information necessary to rear queens on a large commercial scale.

Many beekeepers are being disappointed in queens purchased from commercial breeders This dissatisfaction is not because the queen breeders are shipping inferior queens, but because queens shipped through the mail in the regular cages, or even in pound packages seem to have lost much of their vitality and, consequently, have a greatly reduced period of egg laying. Just why the shipping of queens seem to reduce the vitality and to shorten their life in many cases is not known. The beekeepers have experienced this for many years and in many instances the queen breeder has been unjustly accused of shipping inferior queens.

The preceding statement is not intended to convey the impression that queens should never be purchased. It is essential that the beekeeper has a good strain of Italian bees before attempting to rear his own queens. The comparative freedom from stings, saying nothing about the other good qualities, will more than repay for Italianizing the apiary. It is also advisable to introduce new blood into the yard from time to time so that the stock will be kept pure and there is always the possibility that superior honey gatherers may be introduced.

A black or hybrid queen is expensive to maintain in the bee yard. A colony headed by a black or hybrid queen usually has a very poor disposition and such a colony suffers from lack of proper manipulation. Black bees should never be allowed in a bee yard located within a town or city limits. Opposition to the keeping of bees in town would be much less frequent if all such colonies were Italian bees.

Selecting the Breeder.

Instead of a haphazard selection of the colony to be used for breeding purposes, there are several points that should be taken into consideration. Every beekeeper knows that some colonies have many good qualities that are lacking in others. It is the good qualities that the beekeeper should have predominant in his apiary.

There are six principal points that should be considered in selecting the breeder.

1. None-swarming. There is a great difference in colonies in their tendency to swarm. Choose one in which the swarming instinct is not predom-

inant. Non-swarming should be given only secondary consideration but should not be forgotten altogether.

2. Gentleness. In many respects this is of minor importance. Do not breed for gentleness at the expense of the more important qualities. It is a desirable trait in a colony and makes work with the bees much more pleasant. Many beekeepers would take better care of their colonies if it were not for the stings of their cross bees.

3. Color. Do not breed for color alone. Color is, however, the only means of determining the purity of the strain. There are three kinds of Italian bees: namely, three banded, goldens, and leather colored.

The three banded Italians are considered by the majority of beekeepers as the best. This type of bee should have three prominent yellow bands commencing with the segment of the abdomen where it is attached to the thorax. The yellow bands produced by the fine hair of very young bees should not be taken into consideration.

Golden Italians have four or five yellow bands on the abdomen. It is very seldom that an all yellow bee is found. When the bee emerges it appears as an all yellow bee, but soon after starting its short and strenuous life, the fine hairs wear away and the black markings can be plainly seen.

The leather colored Italians have but two prominent yellow bands and therefore appear a little darker than the three banded. The third band will show, if the bees are full of honey, when placed on a window so that the light can shine through the abdomen. The leather colored Italian is typical of the native bees in Italy.

4. Drone Selection. Do not allow a miscellaneous assortment of drones in the yard. Eliminate the undesirable drones as far as possible and give the good colonies plenty of drone comb. The drone rearing colonies should be selected for the same qualities that the beekeeper has in mind when selecting his breeding queen.

5. Resistance to European Foul Brood. This is of first importance to beekeepers located in European Foul Brood territory and should not be overlooked by beekeepers who have never had the disease in their yards. It may be introduced into disease-free territory. Italian bees are the only bees that are practical for cleaning up European Foul Brood.

6. Honey Gathering Qualities. To commercial beekeepers this quality is absolutely essential. Without surplus gathering bees, they cannot stay in the business. The breeding colony should be one of the best surplus producing colonies in the apiary.

Method of Rearing Queens.

Under methods of rearing queens only two of the most extensively used will be discussed. A discussion of the many processes being used with success has a tendency to confuse the beginner. The beekeeper having succeeded with one of the following methods may later modify it to suit his individual conditions.

Cell Building Colonies.

In producing queens it is important to give attention to the colony that will draw the cells. There is a great difference in the manner in which colonies will draw out queen cells and feed the larvæ. Some hives are very saving with the royal jelly placed in the queen cells, often not giving enough

food for the proper development of the queens. Others supply the larvæ in great abundance with this rich, precious food, a surplus often being found in the base of the cells after the queens have emerged.

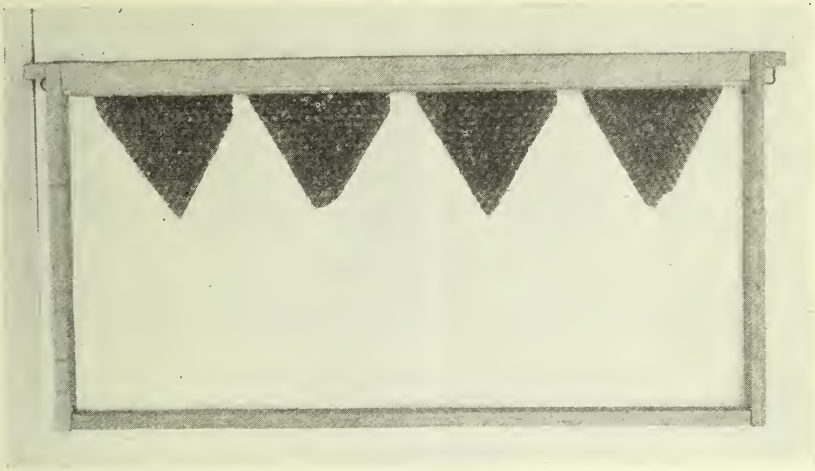

Fig. 1. Dr. C. C. Miller method of fastening foundation in frame.

Queen larvæ, with an abundance of food, develop into the best queens. For a cell building colony, select one that is not miserly with its royal jelly. This can be determined by observing the natural built queen cells. The beekeeper will have to resort to artificial means if there are no natural built cells. This is done by placing artificial cells in several colonies and testing them out.

It is not advisable to use natural cells built by queenless colonies. Queenless colonies, in their great haste to overcome this handicap, start feeding royal jelly to some larvæ too old to develop into good queens. The old larvæ, when fed royal jelly, develop into queens of inferior quality and never produce the colonies that queens developed from very young larvæ produce.

Many beekeepers plan on requeening by killing the old queen and allowing the bees to rear a queen from the brood in the hive. This is not considered a good practice by many and the writer has never found it satisfactory in his own yard. In this method the old queen is generally killed near the beginning of the honey flow.

Dr. C. C. Miller's Method.

Fasten triangular or rectangular strips (fig. I) of foundation to the top bar of an ordinary Hoffman frame. Place this prepared frame in the center of the brood nest of the colony selected as a breeder. As soon as the foundation has been drawn out and eggs deposited in the cells, usually in three to five days, remove the frame and with a sharp knife cut the edge of the comb back to the cells with eggs in them. Place this frame in a cell building colony which has been previously made queenless. (The queen may be saved by placing her in a cage in another hive or she may be introduced to a nucleus). The Miller frame may be placed above the excluder of a queen-right colony as

described under the Doolittle method, (Page 8). If the frame is introduced to the cell building colony within a day or two after being made queenless, the original brood combs must be examined on the sixth day after being made queenless. All queen cells started by the bees should be removed. If the colony is made queenless ten days prior to the time the Miller frame is to be put in, an examination of the colony should be made on the sixth and tenth days after being made queenless and all queen cells cut out. If this is done carefully there is no further danger from a queen emerging prematurely, there being only eggs or very young larvæ in the cells of the Miller frame.

On the tenth day after placing the Miller frame in the cell building colony, the queen cells will all be capped. Remove the cells by carefully cutting the comb far enough back of the bases of the cells to prevent injury, and introduce them into the colonies to be requeened or into mating nuclei.

Doolittle Method.

The Doolittle method of queen rearing or modifications of it is the most popular system in use, especially by commercial queen breeders.

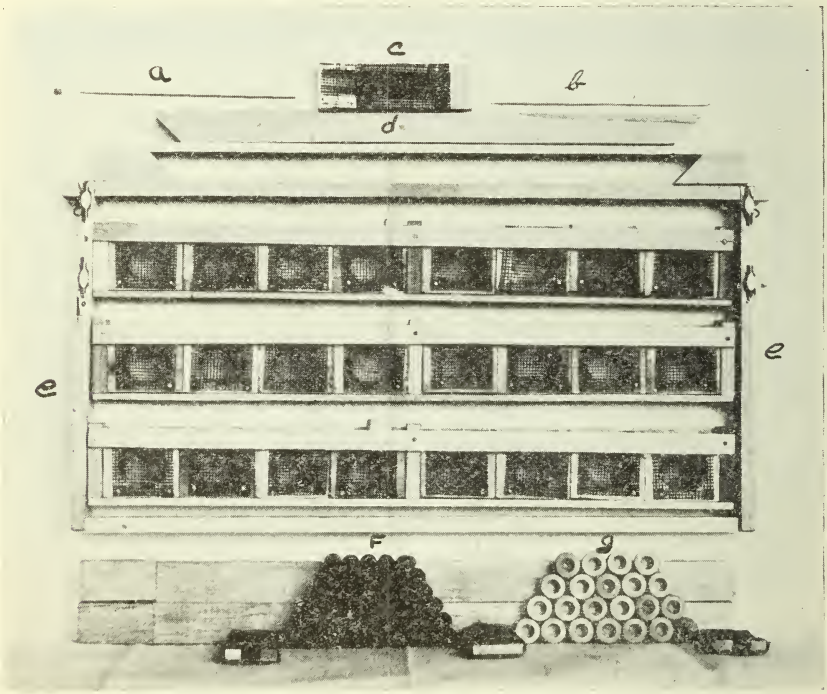

Fig. 2. Queen rearing equipment. A. royal jelly spoon; B, grafting spoon or transferring needle; C, Miller queen cage; EE, nursery cages and nursery cage frame; F, wax cell cups; G, wooden cell cups.

Equipment. In this system there is a small amount of equipment with which the beekeeper must supply himself. It may be made by the beekeeper himself. However, most people find that it pays to purchase at least some of the articles from a bee supply house. The equipment needed is listed below, see cut, (Fig. 2).

Wooden cell cups.
Wax cell cups.
Cell cup stick. (Fig. 3).
Grafting spoon—for transferring larvæ from comb to cell cups.
Royal jelly spoon—for lifting royal jelly from discarded queen cells and depositing in container.
Cell bar frame. (Fig. 3).
Royal jelly—obtained from queen cells that are cut out and destroyed and the royal kelly kept in a small stone jar with screw top lid; viz: cold cream jar. During the season there are queen cells started in many colonies that are removed in the usual swarm control methods. There are occasionally artificial cells that become damaged and it is from these cells that the beekeeper should depend on his supply of royal jelly. Royal jelly can be kept in a tight container for months. The royal jelly may be thinned with a small amount of saliva or warm water if it becomes too thick.

Starting the Cells.

Insert the wax cell cups in the wooden cups by means of the wet cell cup stick. The end of this stick should be just the size and shape of the inside

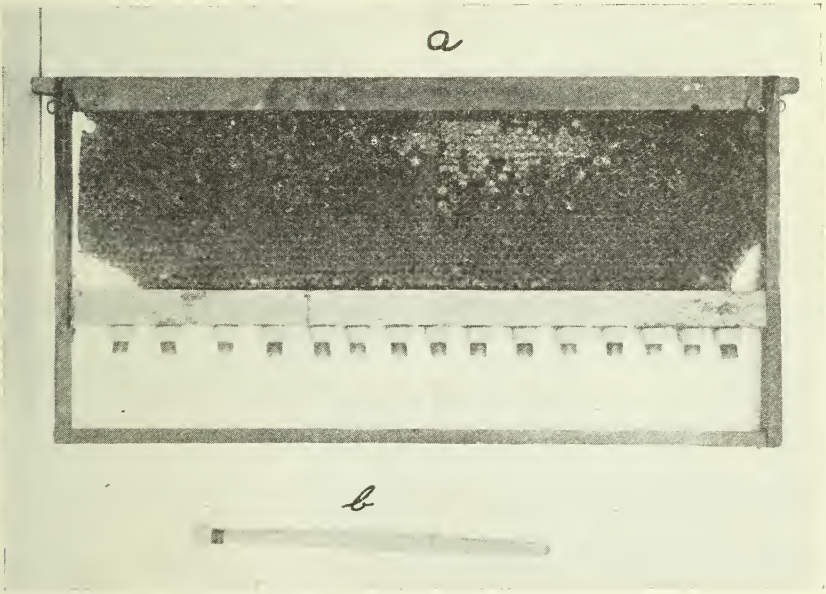

Fig. 3. A, cell bar frame; B, cell forming stick, showing method of fastening wax cup to wooden cup

of the wax cup so that the base of the wax cup can be pressed firmly against the base of the wooden cup.

Before the cell cups are placed on the cell bar, the frame should be placed in the brood nest and the bees allowed to draw out the foundation in the upper half. After that is done the frame is taken out and the cell cups fastened on the center bar (Fig. 3) by the pins in the base of the wooden cups. If

there are no pins in the wooden cups they can be fastened on very securely by placing a thin layer of wax on the bases of the cups and pressing them firmly on the bar. From ten to fifteen cups are generally used on one bar.

A small amount of royal jelly (amount used equal to about one-half the size of a small pea) is placed in the base of the wax cup. If the royal jelly is scarce a much smaller amount will serve the purpose. A frame with larvæ not over three days old, preferably about thirty-six hours old, is then removed from the colony selected for a breeder. For the beekeeper with normal eyesight, larvæ that can be just readily seen with the naked eye are of the right age. Transferring the larvæ is done with the grafting spoon. The spoon is carefully slipped under the minute larvæ, being careful not to bruise them, and then lifted out and slipped off of the spoon on the royal jelly in the wax cell cup. This work should always be done on a bright day and with a temperature of not less than 80 degrees F.

Having grafted all of the cells, the frame is ready to be placed in the hive. Many beekeepers use a queenless colony to get the cells accepted and started. However, the general practice is to raise the brood (both young and emerging). All the brood is taken from the brood chamber with the exception of one frame left below with the queen. The brood combs are replaced with empty combs for the queen to lay in. This brood is placed above the excluder, on the same colony and the frame of grafted cells placed in the center of the brood. Many beekeepers believe that better results are secured if one or two extracting supers are placed between the excluder and the cell building chamber. Sugar syrup should be poured over the frames so that the bees will start work more readily on the cells. A small garden sprinkling can is good for this feeding. The cells will be drawn out and capped in this chamber because everything above an excluder is queenless as far as the bees are concerned in cell building.

Where young brood is raised above an excluder great care must be taken in finding and cutting out the queen cells started on the combs. A queen cell started from an old larvæ will hatch before the artificial cells are ready to be removed and such a queen will destroy all of the developing queen cells.

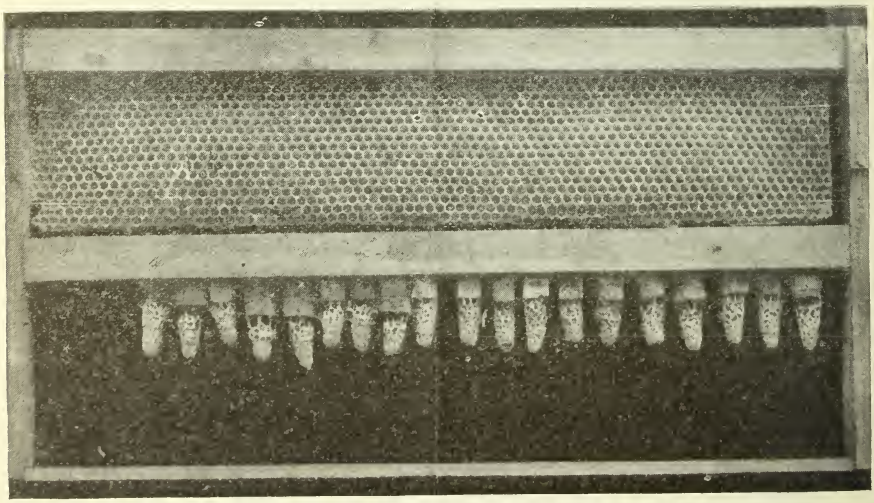

Fig. 4. Capped queen cells ready to be removed from the cell bar. (Courtesy Michigan Agricultural College).

Ten days after the grafted cells are placed in the cell building colony they should be capped and ready to emerge in another day or two (Fig. 4). Do not let the cells remain in the colony longer than the tenth day. To do so would probably destroy all of the cells. If one queen emerges she will do her best to see that the remaining cells are destroyed. Do not trust to memory for the date that the cell bar was grafted, but write it down some place where it can be found.

The cell building chamber can be used indefinitely by raising two or three frames of emerging brood every week. The raising of the emerging brood provides a constant supply of nurse bees to care for the queen cells.

Time to Rear Queens.

The commercial queen breeder cannot select the most desirable time to rear queens, but must use artificial means to secure results. The beekeeper rearing queens for his own use can usually wait until conditions are suitable for the work. To secure the best results the air temperature should range from warm to hot and there should be nectar coming in. It is not necessary to have a heavy flow, a light steady flow will serve the purpose. If the flow should stop the colonies that are drawing cells must be fed with a thin sugar syrup.

If there are queenless colonies early in the spring, do not attempt to rear queen cells but order a queen from some Southern breeder. Good queens cannot generally be reared in the early spring months in Michigan because of the low temperature. Commercial breeders in this State do not plan on filling orders for queens before May 15 to June 1.

Caring for the Capped Queen Cells.

Queen cells should always be handled with the greatest of care. A queen cell handled roughly—turning them up-side-down, bruising, dropping, chilling—will often result in killing the pupa or in the emerging of an imperfect queen.

Mating Nuclei.

The capped cells having been removed from the cell bar, they may be introduced directly into the colonies to be requeened, or the cells may be introduced to mating nuclei.

There are a number of different styles of mating nuclei hives being used and the majority of them require special equipment.

The most economical method of making mating nuclei equipment is to use eight or ten frame hives. The hives are divided into bee tight compartments, each compartment holding two Hoffman frames. The entrances are so arranged that no two are on the same side of the hive. The top of each nucleus is covered with a piece of oilcloth. Great care must be taken to make the partitions between the compartments absolutely bee tight.

The formation of the mating nuclei is a simple matter when the standard eight or ten frame hive is used. One frame of emerging brood and adhering bees, and one frame of honey and pollen is placed in each compartment. The entrance to each newly formed nucleus should be closed with grass. Twenty-four hours later the grass should be removed and the cells or virgin queens may be given to the newly formed nuclei.

The mating queen should not be allowed to remain indefinitely in the mating nucleus as she will soon fill the empty cells with brood and swarm out.

Nursery Cages.

Some beekeepers prefer placing the capped cells in nursery cages. When the nursery cage is used the cages are placed in a specially constructed frame, (Fig. 2). This frame is then placed in the brood nest where the proper incubation temperature is maintained and there the queens emerge. The virgin queens are fed through the wire screen by the nurse bees. The virgin queens should be removed from the nursery cages and introduced within a day or two after emerging. The majority of queen breeders and beekeepers prefer to introduce the queen cells direct.

If the beginner is not successful in getting the first cell bar accepted, try again within a few days. Quite often the second or third bar of cells is more readily accepted than the first.

To the beginner, the rearing of queens presents many intricate problems but by careful study and giving strict attention to the small details the novice should readily overcome them.

To any beekeeper who desires to go into queen rearing extensively, the writer would suggest that one or more of the books on queen rearing be secured and studied diligently.

Following is a list of some of the available books on queen rearing.

Practical Queen Rearing—Pellet.
Scientific Queen Rearing—Doolittle.
A. B. C. & X. Y. Z. of Bee Keeping—A. I. and E. R. Root.
Modern Queen Rearing—M. T. Pritchard.

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ON SUCCESSFUL BEEKEEPING.

EUROPEAN FOUL BROOD

BY

B. F. KINDIG,

Director Apiary Inspection

BULLETIN No. 5

May 1, 1922

EUROPEAN FOUL BROOD

European Foul Brood is a bacterial disease which causes the death of the larvae of workers, queens, and drones. It attacks them normally when they are about three days old and usually kills them before the cells are capped. The disease is quite variable in its severity; in some cases most of the uncapped larvae are affected while in other colonies or under different conditions of season or honey flow, but very few larvae may be attacked.

DISTRIBUTION

European Foul Brood is found in nearly every county in the central, southern, and western part of the Lower Peninsula. Several years ago Dr. E. F. Phillips of the Bureau of Entomology, United States Department of Agriculture, called the attention of the writer to what seemed to be a striking coincidence, in that European Foul Brood seemed to be particularly virulent on the poorer types of soil. The truth of this statement seems to be well borne out in the distribution of the disease in the various counties. While the disease is frequently met with on the heavier types of soil, yet it appears as a serious menace largely on the lighter soils where there is but little incoming nectar during the spring and early summer months. There are many counties in the State from which the disease has not been reported. This should not be construed to mean that such territories are immune from the malady. On the contrary, it seems to be purely an accident that this trouble has not appeared in many of these counties.

PREDISPOSING CONDITIONS

As noted above, areas in which there are but few nectar secreting flowers during the early part of the season seemed to be favorable for the development of the disease. As Italian bees are essential for the control of this disease, it therefore follows that in those communities where the black bees predominate European Foul Brood is particularly serious. It has also been noted that the poor wintering of bees is exceedingly favorable to rapid progress of the disease. Those colonies are particularly susceptible which are weak in numbers and slow to build up either because of insufficient strength or because of the presence of a failing queen.

STRENGTH OF COLONY IN RELATION TO DISEASE

Strong colonies of bees attempt to eradicate the disease from the hive by carrying out the dead larvae. This reminds one of the reaction of a strong colony to the presence of wax moths. Weak colonies seem to make but little effort to clean out the diseased larvae as they appear. The carrying out of the dead larvae seems to be an important factor in retarding the spread of the disease within the colony. Nurse bees have

often been observed sucking the juices from the bodies of the dead larvae. Doubtless the nurse bees, because of their contamination with the bacteria, form the principal agency in the dissemination in the hive.

Very little is definitely known regarding the spread of the disease from hive to hive or from one apiary to another. It has been definitely shown, however, that the disease can be transferred by the agency of the honey taken from the diseased colonies.

DIAGNOSIS

The larvae are first affected by European Foul Brood while they are curled up in the backs of the cells adjacent to the midrib of the comb. Frequently the larvae seem to move about slightly before death and dead larvae change in color from pearly white to gray or yellow and if permitted to remain in the cells they may become a yellowish brown or brown in color. The larvae do not adhere tightly to the cell walls. In various cases there is usually a decided odor. There is but slight ropiness, if any at all. Queen, worker, and drone larvae seem to be equally susceptible to the disease.

In case of any doubt in diagnosis of disease, write to the Director of Apiary Inspection, Department of Agriculture, Lansing, Michigan asking for a box in which to mail a sample of the diseased comb. The comb should not be wrapped in waxed paper nor mailed in tin containers.

TREATMENT

During the past ten years the methods of treatment for European Foul Brood have been changed quite radically. The transferring of the bees from the diseased hive is no longer advocated.

E. W. Alexander of New York and Dr. C. C. Miller of Illinois, demonstrated conclusively that the destruction of combs and the loss of brood were unnecessary in treating this disease. Dr. E. F. Phillips has summed up the whole matter of preventive measures: "The practices of good beekeeping are those which result in the eradication of European Foul Brood." *

Every beekeeper should look forward to the possibility of European Foul Brood becoming epidemic in his apiary. Preventive measures are therefore indicated rather than awaiting the coming of the disease and then attempting to remedy the situation. The following points are particularly important in this connection: Young queens, an abundance of food, suitable winter protection, Italian blood, and strong colonies.

In combating the disease after it has appeared, the queens of the diseased colonies should be killed and Italian queens of known resistance should be introduced as soon as the bees have had an opportunity to free the combs from all dead larvae. The length of time required for removing the dead larvae depends upon the race of bees and strength of the colonies as well as the amount of infection present. If colonies are weak, it is frequently desirable to unite two or more colonies. The uniting of two weak discouraged diseased colonies frequently results in

*Farmers' Bulletin 975, "The Control of European Foul Brood" by Dr. E. F. Phillips.

a complete change of morale and a quick cleaning up of the diseased material.

In those apiaries where most colonies are headed with resistant stock, it is unnecessary to send away for queens. Ripe queen cells from the best queens may be introduced into the colonies at the time the old queens are killed or a few days later depending upon the severity of the disease. If the cells are introduced some time after the removal of the queens, then a careful examination of the combs must be made and all queen cells removed before introducing the ripe cells. Negligence in this matter may result in a hopelessly queenless colony due to the destruction by the bees of the cell introduced and by the blasting of the cells reared by the colony because of the disease present.

In connection with the treatment for disease, beekeepers frequently find it advantageous to feed a thin syrup at frequent intervals. After requeening all diseased colonies the beekeeper should keep very close watch of the performance of the various queens. He should begin rearing young queens from those queens which seem to produce colonies most resistant to the disease. The beekeeper should not depend entirely upon purchasing queens from regular queen breeders. He should learn to rear his own queens from those which he knows are fully capable of carrying their colonies through the season without a severe outbreak of disease. The vigor of a queen seems to be impaired by shipping through the mail. Vigor is of exceeding importance in queens in apiaries where disease is present. The beekeeper should therefore exert all possible effort to the end that he may produce all of his own queens. A bulletin on the rearing of queens is available for distribution by addressing the Department of Agriculture, Lansing, Michigan.

MICHIGAN DEPARTMENT OF AGRICULTURE
LANSING, MICHIGAN

European foul brood is the cause of a tremendous economic loss to Michigan because often the disease so weakens the colonies that they are unable to store a surplus of honey. In this circular, it is the desire to bring to the attention of beekeepers of Michigan these practices which will reduce the loss of brood in the spring time and result in the gathering of a much greater crop.

JOHN A. DOELLE,
Commissioner.

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